

What is claimed is:

1 1. A zoom lens formed of only three lens groups, arranged along an optical axis in order from
2 the object side, as follows:

3 a first lens group of negative refractive power;

4 a second lens group of positive refractive power; and

5 a third lens group of negative or positive refractive power;

6 wherein

7 the first and the second lens groups are moved so that the first and second lens groups
8 become closer together during zooming from the wide-angle end to the telephoto end;

9 the first lens group includes at least one lens element that includes at least one aspheric
10 lens surface; and

11 the shape of said at least one aspheric lens surface is given by an aspheric lens equation
12 that includes at least one non-zero coefficient of an even power of Y , and at least one non-zero
13 coefficient of an odd power of Y , where Y is the distance of a point on the aspheric lens surface
14 from the optical axis.

1 2. The zoom lens of claim 1, wherein:

2 the third lens group has positive refractive power;

3 the second and third lens groups become farther apart during zooming from the wide-
4 angle end to the telephoto end;

5 the second lens group includes a stop for controlling the amount of light that passes
6 through the zoom lens; and

7 the third lens group is moved toward the object side while focusing from infinity to a near
8 point.

1 3. The zoom lens of claim 2, wherein:

2 the second lens group includes, arranged along the optical axis in order from the object

side, a lens component formed of a first lens element having a biconvex lens shape and a second lens element having a biconcave lens shape that is intimately bonded to the first lens element; the third lens group has positive refractive power; wherein the following conditions are satisfied:

$$d / f_w < 0.15$$

$$vL_3 - vL_4 > 15$$

where

d is the on-axis spacing between the image-side lens surface of the biconcave lens element in the second lens group and the lens element having positive refractive power and a meniscus shape in the second lens group;

f_w is the focal length of the zoom lens at the wide-angle end;

vL₃ is the Abbe number of the biconvex lens element of the second lens group, and

vL₄ is the Abbe number of the biconcave lens element of the second lens group.

4. The zoom lens of claim 1, wherein:

the second lens group includes, arranged along the optical axis in order from the object side, a first lens element, a second lens element having a biconcave lens shape that is intimately bonded to said first lens element so as to form a first lens component, and a second lens component; and

each of an image-side edge portion of said second lens element and an object-side edge portion of said second lens component includes a flat surface and the flat surfaces are parallel and in contact with each other, or each flat surface is parallel and in contact with one of two opposite parallel sides of a plate that separates said second lens element from said second lens component.

5. The zoom lens of claim 4, wherein said second lens component consists of a lens element.

6. The zoom lens of claim 1, wherein:

the first lens group includes, arranged along the optical axis in order from the object side,

a first lens component of negative refractive power, and a second lens component of positive refractive power;

the second lens group includes a stop for controlling the amount of light that passes through the zoom lens;

the second and third lens groups remain the same distance apart during zooming from the wide-angle end to the telephoto end; and

the third lens group is moved toward the object side during focusing from infinity to a near point.

7. The zoom lens of claim 6, wherein each of said first lens component and said second lens component consists of a lens element.

8. A zoom lens formed of only three lens groups, arranged along an optical axis in order from the object side, as follows:

a first lens group of negative refractive power;

a second lens group of positive refractive power; and

a third lens group of negative or positive refractive power;

wherein

the first and the second lens groups are moved so that the first and second lens groups become closer together during zooming from the wide-angle end to the telephoto end;

the first lens group includes at least one lens element that includes at least one aspheric lens surface; and

the shape of said at least one aspheric lens surface is given by an aspheric lens equation that includes at least one non-zero coefficient of an even power of Y , with said even power of Y being less than Y^{16} and at least one non-zero coefficient of Y^i , where i is an even number of 16 or greater, and Y is the distance of a point on the aspheric lens surface from the optical axis

9. The zoom lens of claim 8, wherein:

the third lens group has positive refractive power;

the second and third lens groups become farther apart during zooming from the wide-angle end to the telephoto end;

the second lens group includes a stop for controlling the amount of light that passes through the zoom lens; and

the third lens group is moved toward the object side during focusing from infinity to a near point.

10. The zoom lens of claim 9, wherein:

the second lens group includes, arranged along the optical axis in order from the object side, a lens component formed of a first lens element having a biconvex lens shape and a second lens element having a biconcave lens shape that is intimately bonded to the first lens element; and

the following conditions are satisfied:

$$d / f_w < 0.15$$

$$vL_3 - vL_4 > 15$$

where

d is the on-axis spacing between the image-side lens surface of the biconcave lens element in the second lens group and the lens element having positive refractive power and a meniscus shape in the second lens group;

f_w is the focal length of the zoom lens at the wide-angle end;

vL₃ is the Abbe number of the biconvex lens element in the second lens group, and

vL₄ is the Abbe number of the biconcave lens element in the second lens group.

11. The zoom lens of claim 8, wherein:

the second lens group includes, arranged along the optical axis in order from the object side, a first lens element, a second lens element having a biconcave lens shape that is intimately bonded to said first lens element to form a first lens component, and a second lens component; and

each of an image-side edge portion of said second lens element and an object-side edge

23 portion of said second lens component includes a flat surface and the flat surfaces are parallel
24 and in contact with each other, or each flat surface is parallel and in contact with one of two
25 opposite parallel sides of a plate that separates said second lens element from said second lens
26 component.

1 12. The zoom lens of claim 11, wherein said second lens component consists of a lens element.

1 13. The zoom lens of claim 8, wherein:

2 the first lens group includes, arranged along the optical axis in order from the object side,
3 a first lens component of negative refractive power, and a second lens component of positive
4 refractive power;

5 the second lens group includes a stop for controlling the amount of light that passes
6 through the zoom lens;

7 the second and third lens groups remain the same distance apart during zooming from the
8 wide-angle end to the telephoto end; and

9 the third lens group is moved toward the object side during focusing from infinity to a
10 near point.

1 14. The zoom lens of claim 13, wherein each of said first lens component and said second lens
2 component consists of a lens element.